Introduction

Thanks to the fascinating world of computers. Today, computers have become the part and parcel of our lives Every field and activity of our life is now affected and benefited by the use and application of the computers and computer technology. Education is not an exception. Today, the teaching and learning is making use of computers in so many forms and ways. So, a learner or teacher is in a need of some working knowledge of the use of computers. This chapter will provide a necessary background for understanding the concept, structure and functioning of computers in the manner we often make use of them in our school's computer lab.

What are Computers

For tracing the evolution of computers, we will have to go back to the age of discovery of numbers and counting systems. Counting with the aid of pebbles was perhaps the first calculating technique used by the human beings. However, the credit for being called as the first computer goes to 'Abacus' a counting machine used by the ancient Orientals. It is more than 5000 years old and is still the primary form of "number crunching" in many parts of the world. In its present form, it makes use of beads to represent decimal numbers as shown in Fig. 31.1.
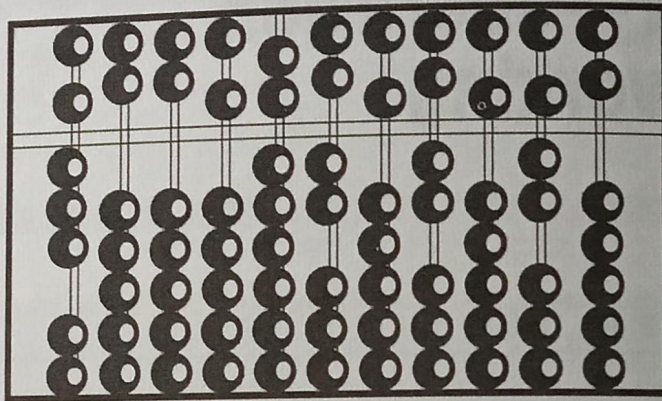

Figure 31.1 Abacus

The next attempt after the invention of the Abacus, for automatic computation, was made by a French scientist Blaise Pascal in 1642. He invented an arithmetic machine actually for the purpose of helping his father in his business of tax collection. This machine had eight wheels, each wheel having the numbers 0 to 9 painted on it. The wheels were attached to gears. The gears, in turn, were attached to each other in such a way that simple addition and subtraction could take place by dialing the amounts to be added or subtracted. Pascal's machine was, in fact, the first calculator and non-portable computer of the world. The computer world has acknowledged his contributions by naming a computer programming language as 'Pascal'.

In view of the above-mentioned historical evolution and also on its literal meaning, the term 'computer" stands for a device helpful in computing or calculating at a faster speed with greatest possible accuracy. However, as we know about the modern computers, their field is not limited to computation. They handle any type of information or data and work in almost all the fields of human endeavour. Therefore, to define them merely as a device helpful in computation is not justified. In search of some alternative definition, we can safely consider a computer as **a thinking machine of the human being that makes use of some well-framed meaningful programmes (software) for its operation and utilities.** Therefore, as a programmable machine, every computer is known to possess the following two characteristics:

1. Responding to a specific set of instructions, in a well defined way.
2. Executing a pre-recorded list of instructions (a programme) for performing various tasks.

In the language of technology, every computer is composed of two components (i) hardware (its machine like body), and (ii) software (the instructions followed for its operation and data which it processes for its utility).

Classification of Computers

Modern computers are electronic and digital. These digital computers are broadly classified into the following four categories depending upon their performance, size and cost:

1. Microcomputers (or micros)
2. Minicomputers (or minis)
3. Mainframes
4. Super computers

Microcomputers

These are low-cost small-size computers. These have been so named on account of their employing micro-processors. They represent a typically single-user systems, meaning that a microcomputer can be used by only one user at a time. The personal computers (PC) that you are using in your computer laboratory are microcomputers. These are named personal on account of being used by any person (without specialized training) for his personal use.

Minicomputers

These perform better, are larger in size, and cost more than microcomputers. They also possess larger storage capacities and are faster. Normally, they are designed to support more than one users at a time. That is why these may also be used as servers in local area network (LAN). Minicomputer, thus as a multi-user computer, can support ten to hundreds of users simultaneously.

Mainframes

These computers are more powerful and faster than minicomputers. They have a quite larger storage capacity and are able to support many hundreds of users simultaneously. Their real values lie in their processing power to handle large database systems, i.e. handling the records of thousands of employees working in an organization. On account of their large support base, they can be safely used as servers in WAN.

Super computers

Where microcomputers lie at the lowest end of the computer range, the super computers stand at the highest end (apex). They are the most powerful, fastest and expensive machine and thus, can be afforded only by rare organizations working on the national level. These computers have remarkable performance as billions of calculations may be performed by them in a second. Some of the areas in which these are in use are sophisticated scientific and biomedical

researchers, weather forecasting, designing of sophisticated machines and warfare equipment, etc.

General Structure and Working

The structure and working of a computer resembles the human brain. In general, a computer system consists of the subsystems, namely: (i) Input, (ii) Memory, (iii) Arithmetic and logic, (iv) Output, and (v) Control.

1. The **input** subsystem in the form of keyboard cassette recorder, etc. works for putting outside information in the machine just as our eyes, ears and other sense organs work for our brain to collect information from the environment.
2. The **memory** subsystem helps in storing information and data electronically which can be retained indefinitely and used when needed. However, this memory is erasable and hence the stored information can be replaced with new one within a few microseconds.
3. The **arithmetic and logic** subsystem is the arithmetic and logic mind of the computer. It is responsible for all types of data manipulation and computation work. This work is carried out with an unimaginable accuracy and extremely high speed.
4. The **output** subsystem resembles the output system of our brain to furnish the answered information. Whereas in our case it is done orally and by writing, in computers it is carried out through display (visualized) in the screen of the monitor, the printer (in the form of printed material) or the cassette recorder (voice).
5. The **control** subsystem, as the name suggests, controls the execution of the programme and coordinates all the activities of the computer. It functions in two phases in a cyclic manner: (i) the instruction phase, and (ii) the execution phase. In the former a command of the programme is brought to the control subsystem from the memory, and in the latter the command is executed.

The arithmetic and logic and the control subsystems together is called the central processing unit (CPU) or simply the **processor** signifying that what is to be processed in the machine is done through CPU (Fig. 31.2).
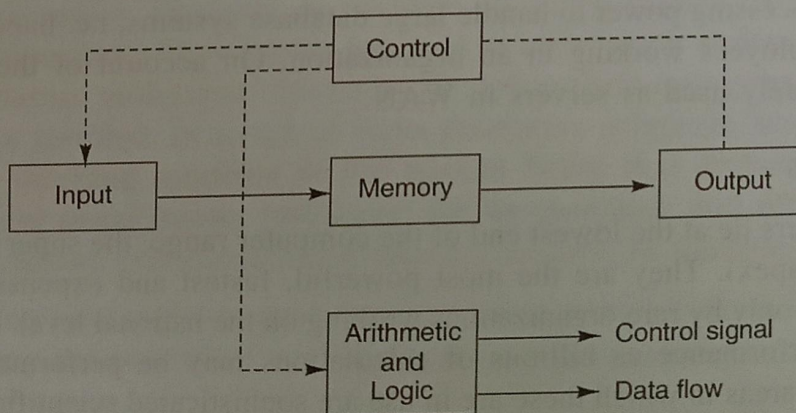
Figure 31.2 Working and organizational structure of the subsystems of a computer.

The computers in all their sizes and applications are machine-like devices and, thus, belong to the family of hardware. They possess vast memory, unusual flexibility and unimaginable scope for computing and manipulating data in unlimited ways. For this purpose, like other hardware, computers make use of software. The software used in them is in the form of a written programme prepared by human being. A computer works in the manner what it gets in the form of programme. That is why, the computer in itself is not an independent thinking machine, but a machine of a thinking man, the programmer. The job of a computer programmer is quite technical which needs the knowledge of the language spoken by the computer and its coded specific instructions, besides the knowledge of the subject matter and instructional technology.

Language of a Computer

The computer language serve much the same purpose as a human language, i.e. communication. But they can't communicate in the languages of ours. They have their own languages such as BASIC, PILOT, LOGO, FORTRAN, COBOL, and JAVA, etc. If we wish to communicate with them, we have to know their languages. Each of these languages tries to adopt a particular type of number system—binary, hexadecimal or octal system, etc.,—in place of the usual decimal system adopted by the human beings for the general computation work. Most of the computers make use of the binary system with two-digit symbols, 0 and 1 (instead of ten digits, 0 and 1 to 9) for expressing any number as illustrated in Table 31.1.

TABLE 31.1

Number	Expressed in Computer Language
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000

For expressing in computer language, the alphabet, operations, etc. are first given specified code number as given in Table 31.2 and then transformed into computer's language.

TABLE 31.2

Instruction	Operation Code No.	Expressed in Computer Language
Add	1	0001
Subtract	2	0010
Multiply	3	0011
Divide	4	0100
Read a card	5	0101
Square	6	0110
Draw a line	7	0111
Transform	8	1000